

ACCESSION #: 9910260031

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Browns Ferry Nuclear Plant Unit 2      PAGE: 1 OF 7

DOCKET NUMBER: 05000260

TITLE: Reactor Scram due to Moisture Separator High Level

EVENT DATE: 09/17/99 LER #: 1999-010-000 REPORT DATE: 10/15/99

OTHER FACILITIES INVOLVED:      DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 30

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

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Manager

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: SB COMPONENT: LT MANUFACTURER: F180  
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On September 17, 1999, at 1702 Central Daylight Time, during reactor startup operations at 30 percent power, a high water level in main steam moisture separator 2C2 caused a Unit 2 main turbine trip. This resulted in an automatic reactor scram on turbine stop valve closure. Safety systems responded as expected and all control rods fully inserted. The cause of the high level in the moisture separator was a failed high level controller for the 2C2 moisture separator drain reservoir. The 2C2 reservoir level transmitter and relays were replaced and tested satisfactorily. Unit 2 was restarted on September 18, 1999.

TVA is reporting this event in accordance with 10 CFR 50.73 (a)(2)(iv) as an event that resulted in an actuation of an engineered safety feature, including the reactor protection system.

END OF ABSTRACT

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## I. PLANT CONDITIONS

Prior to the initiation of the event, Unit 2 was at 30 percent power and Unit 3 was at 100 percent power. Both units were in Mode 1. Unit 1 was shutdown and defueled.

## II. DESCRIPTION OF EVENT

### A. Event:

During a reactor startup on Friday, September 17, 1999, at 1530 hours Central Daylight Time (CDT), the Unit 2 main control room received an annunciation indicating a high water level in main steam moisture separator 2C2 level control reservoir [SB]. The Outside Unit Supervisor (US) was dispatched to investigate the situation at the local control panel. The high level controller for the 2C2 moisture separator reservoir was observed to be indicating downscale and the normal level controller was indicating full scale. The other moisture separator reservoirs were at various levels as indicated by the normal and high controllers. The US directed that the heat-up and drain alignment for the moisture separators be completed by opening the drain pump suction valves, and observed water level reducing on 5 of the 6 level control reservoirs. The 2C2 level control indicators did not respond, which was diagnosed by the US as an instrument reference leg problem. A work order was written to investigate and correct the problem. At 1702 hours CDT, a Unit 2 main turbine trip occurred on moisture separator 2C2 high level. Reactor power was 30 percent at the time.

The resulting turbine stop valve closure initiated an automatic scram and trip of both recirculation pumps as would be expected. The post trip investigation indicated that the high level controller for the 2C2 moisture separator level drain reservoir had failed, which resulted a high level in the 2C2 moisture separator. The controller level transmitter [LT] and associated relays [RLY] were replaced and tested, and restart operations were resumed on September 18, 1999.

The scram resulted in the expected automatic actuation or isolation of the following PCIS [JE] systems and components on low reactor water level. Some of these components are in their isolated positions during normal

operations. The scram and isolation signals were reset by 1709 hours CDT, and the systems were returned to normal alignment.

- o PCIS group 2, Shutdown cooling mode of Residual Heat Removal (RHR) TEXT PAGE 3 OF 7

[BO] system; drywell floor drain isolation valves; drywell equipment drain isolation valves [WP].

- o PCIS group 3, Reactor Water Cleanup (RWCU) system [CE].
- o PCIS group 6, primary containment purge and ventilation [JM], Unit 2 reactor zone ventilation [VB]; refuel zone ventilation [VA]; Standby Gas Treatment system [BH]; Control Room Emergency Ventilation system [VI].
- o PCIS group 8, Traversing Incore Probe (TIP) [IG].

This event is reportable in accordance with 10 CFR 50.73 (a)(2)(iv), as an event that resulted in the actuation of an engineered safety feature, including the reactor protection system.

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

C. Dates and Approximate Times of Major Occurrences:

September 17, 1999, at 1530 hours CDT Received a 2C2 moisture separator level control reservoir high alarm in the control room indicating a high water level in the reservoir. Dispatched US to investigate. Completed heat-up alignment for moisture separators. Work order written to investigate 2C2 level indicators.

September 17, 1999, at 1702 hours CDT Turbine trip/stop valve closure was initiated by

moisture separator 2C2 high level signal resulting in a automatic reactor scram and recirculation pump trip.

September 17, 1999, at 1709 hours CDT Reset isolations, secured  
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SGTS and CREV, and restarted reactor building and refuel zone ventilation following reset of isolation logic.

September 17, 1999, at 1954 hours CDT A four-hour non-emergency report is made to the NRC pursuant to 10 CFR 50.72 (b)(2)(ii).

D. Other Systems or Secondary Functions Affected:

None.

E. Method of Discovery:

Operators received high water level alarm in 2C2 moisture separator, followed by a turbine trip and reactor scram.

F. Operator Actions:

Operations personnel responded to the event in accordance with applicable plant procedures.

G. Safety System Response:

All required safety systems operated as designed.

III. CAUSE OF THE EVENT

A. Immediate Cause:

The immediate cause of this event was high water level in 2C2 moisture separator.

## B. Root Cause:

The root cause of the failure was a malfunction of the high level controller for the 2C2 moisture separator level control reservoir.

The failed transmitter will be disassembled and inspected to determine if a specific failure mechanism can be identified.

## C. Contributing Factors:

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None.

## IV. ANALYSIS OF THE EVENT

Six moisture separators are provided to remove moisture from steam exiting the high pressure turbine. Additionally, to protect the main turbine from excess water in the moisture separator tanks, a turbine trip is initiated on high water level in any of the six moisture separators. Water level control for the moisture separators is provided by controlling level in separate moisture separator level control (drain) reservoirs. Two Level Indicating Controllers (LIC), a normal and high controller, are installed on each drain reservoir. During low reactor power operation, the normal controller is operated in manual mode and the high level controller is maintained in automatic. At high power levels, both controllers operate in automatic with the normal level controller as the primary control element and the high level controller as a back-up.

Following the high water level annunciation in the 2C2 moisture separator level control reservoir, the Outside US was dispatched to investigate the situation locally. On arrival, the US found the drain reservoir normal and high LICs in the proper mode for low power warm-up and drain of the moisture separators. The 2C2 high LIC was indicating downscale and the 2C2 normal LIC was indicating full scale. Reservoirs A1 and A2 were indicating high level and the high level dump valves were open, and Reservoir B1 went high after his arrival. Reservoirs B2 and C1 were high on the normal range. The US's initial review of the indications and system alignment, and communication with the control room identified that the warm-up valve alignment of the moisture separators was not complete in that the drain pump suction valves were yet to be opened. The moisture separator drain pump suction valves were opened from the control room, completing the warm-up alignment of the moisture separators. When the drain pump suction valves were opened, the US observed level lowering on the other five drain reservoirs as would be expected due to filling of the downstream drain piping. However, the 2C2 level indication did not lower as would be

expected in this alignment. The US diagnosed that the full scale reading on the 2C2 normal LIC was being caused by an instrument leg problem, and believed that the 2C2 high LIC would operate to control level when required. A work order was then written to investigate the 2C2 moisture separator level control reservoir instrumentation indications.

In situ testing following the reactor scram demonstrated that the level transmitter for the high LIC was stuck downscale. Therefore, it was concluded that the upscale reading on the normal LIC was correct at the time. With the high LIC stuck downscale, the high level dump valve to the

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condenser would not auto-operate to drain water from the 2C2 level control reservoir, which subsequently accumulated and backed-up into the 2C2 moisture separator causing a turbine trip at 1702 hours CDT.

A review of maintenance records did not reveal similar problems with the LIC transmitters which are currently on a refuel cycle schedule for Preventive Maintenance (PM). The event investigation also concluded there were some Operator knowledge deficiencies regarding the moisture separator level control reservoir instrumentation operation.

## V. ASSESSMENT OF SAFETY CONSEQUENCES

The evaluation of plant system and component responses to the event concluded that responses were as expected. The normal heat removal path was not lost during this event since the condenser was used for decay heat removal and no main steam relief valves opened. Personnel performance in response to the scram was also evaluated and found to be appropriate an event of this type. In addition, there was no radioactive material released and no actual or potential safety consequences as a result of this event.

## VI. CORRECTIVE ACTIONS

### A. Immediate Corrective Actions:

The Operations crew stabilized the reactor following the scram using the appropriate operating instructions. The 2C2 moisture separator high LIC transmitter and relays were replaced and tested satisfactorily.

### B. Corrective Action to Prevent Recurrence:

A corrective action document was issued to further evaluate the Operator response to the level alarm and to determine if additional training on the moisture separator level control system is warranted.1\_/\_

The PM activity for the moisture separator level control reservoir LICs will be evaluated. In addition, the failed transmitter will be disassembled and inspected to determine if a specific failure mechanism can be identified.1\_/\_

The Alarm Response Procedures for the moisture separator level control reservoirs have been revised to provide directions to take manual control of moisture separator level in the event of level controller system



malfunctions. I\_/

## VII. ADDITIONAL INFORMATION

### A. Failed Components:

Level transmitter 2-LT-006-0083B, a Foxboro Model 15A, failed causing the high level in the 2C2 moisture separator.

### B. Previous Similar Events:

None.

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I\_/TVA does not consider these corrective actions as regulatory commitments. Completion will be tracked in TVA's Corrective Action Program.

### C. Additional Information:

This event did not result in loss of the normal heat removal path as described in draft NEI 99-02, Rev. C, since the condenser was used for decay heat removal.

### D. Safety System Functional Failure:

This event did not result in a safety system functional failure in accordance with draft NEI 99-02, Rev. C.

## VIII. COMMITMENTS

None.

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